apice erosa; anfractibus quatuor, apertura cærulescente, effusa. Pl. VI. fig. 8.
*Hab.* Rio Sacramento, California.

Distinguished from *P. nuclea* of Mr. Isaac Lea, which is from a neighbouring locality, by its somewhat smaller size, bluish instead of white mouth, having one whorl less, the aperture more expanded, and being without the black line round the mouth, which, when present, is so good a character in his shell, but which, in my numerous specimens of it, I do not find at all constant, and usually only to be seen in those better developed.

August 1, 1842.

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## XIV.—*On the spongeous origin of Moss Agates and other siliceous bodies.* By J. S. Bowerbank, Esq., F.G.S.

[Concluded from p. 18.]

In the green jaspers the organic structure of the tissue is often preserved in the most extraordinary manner. The whole of the sponges that are found in this substance that I have examined are referable to that division, which I have proposed, in the paper "On the structure of the keratose sponges of commerce," to designate *Fistularia*, from the fibre being furnished with a central cavity like that seen in *Spongia fistularis* of Lamarck. In one case, especially, which is represented by Pl. II. fig. 5, the dimensions of the fibre and of its central tubes, the size of the interstices, of the network and its mode of arrangement, are, as far as can be ascertained from the small specimen in which they are imbedded, so exactly similar to those of *Spongia fistularis*, Pl. II. fig. 6, as to render it exceedingly difficult to believe them not to be the remains of the identical species in a fossilized state. In the paper on the keratose sponges of commerce read before the Microscopical Society*, I have described one species of the Turkey sponges, and some of the Australian ones as having their solid fibres surrounded by a horny sheath, in which a system of minute anastomosing vessels were imbedded; and as before stated, we find in *Spongia fistularis* the fibre furnished with a continuous central cavity; but I could not detect in either of the two specimens of this sponge that I have had the opportunity of examining any traces of a vascular sheath on the external surface of the fibre. The existence of the combination of these two interesting forms of structure in the

* Trans. Microscopical Society of London, vol. i. p. 37. pl. 3. figs. 11, 12 and 13.

same species remains to be demonstrated from the fossil species found in the green jaspers of India.

On examining a thin polished slice of one of the series of seventy before mentioned, I found a portion of the structure in an exceedingly fine state of preservation. The greater part of the tissue is composed of minute pellucid sponge-tubes, but among these there are occasionally others of much larger dimensions. The central tubular cavities in these are large and exceedingly distinct, and their external surface is furnished with a sheath or coat of a darker green than the other parts of the fibre, in the manner represented in Pl. III. fig. 1, seen with a power of sixty linear as a transparent object. This green coat to the fibre is evidently analogous to the vascular sheath, described in my paper "On the keratose sponges of commerce," as portions of a reticulated structure; is occasionally to be indistinctly observed even with this low power; and when the same parts are examined with a power of 120 linear, the presence of the reticulated structure can be proved beyond a doubt to an observer conversant with the similar tissue in the recent sponges; but fortunately there is one piece of the tissue which demonstrates its existence in the most satisfactory manner. In this piece, which is represented by Pl. III. fig. 2, as seen with a microscopic power of 120 linear, a portion of the fibre has undergone a slight degree of decomposition sufficient to remove the horny or fleshy part of the sheath, but leaving the reticulated vascular structure in a state of preservation almost as perfect as the similar tissues that occur in the recent sponges; for the vessels are as beautifully distinct when viewed with a microscopic power of 500 linear, as represented in Pl. III. fig. 3, as they are in the Australian and Mediterranean sponges.

There are two other specimens in which the reticulated vascular coat of the sponge fibre is preserved, for which I am indebted to my friend Mr. Chas. G. White of Poplar, who found them in two fragments broken out of a diluvial flint. In this case, it is evident that the two small pieces of fibre upon which it is seen are extraneous parts of another sponge which were imbedded in the one that originally gave form to the mass in which they were found. The vascular structure in the smallest piece represented by Pl. III. fig. 4, as seen with a microscopic power of 120 linear, is very like that coating the fibre of one species of the sponges of commerce from the Mediterranean; it possesses the same bold and distinct character, and, like it, throws off short branches, which terminate abruptly in *cæca*; but in the second piece, represented by Pl. III. fig. 5, the character varies somewhat, and resembles the more complex mode of disposition of the analogous tissues in one of the

Australian species, although it differs from it in having a bolder form of vessel. The occurrence of this minute and beautiful tissue in the fossil state, and its perfect accordance in structural character with the recent types, afford the most indisputable evidence of the animal origin of the fibrous structures inclosed within the bodies that are under consideration. The tissues which we have just described are not the only vascular structures that are to be found in these interesting remains. Upon examining the great central cavity of the sponge-fibre represented by Pl. III. fig. 2, at the point *a*, with a power of 120 linear, there is a dark spiral thread or line seen passing down the surface of the cavity for a considerable distance; and when this is examined with a power of 500 linear, it assumes the appearance of a spiral tubular thread, frequently obscured by irregular patches of what appears to have been a glutinous animal matter. In another specimen of green jasper in which this curious tissue occurs, and which is represented by Pl. III. fig. 6, its spiral course is much less obscure, and when examined with a microscopic power of 800 linear its tubular nature is evident. The same structure is also seen lining the cavity of almost every fibre of the sponge in the specimen of green jasper that I have before described as having its structure arranged in foliaceous plates, like the skeletons of the leaves of some endogenous plants.

Another exceedingly remarkable tissue occurs in a moss agate which is probably from Oberstein. In this specimen the sponge-fibre differs materially from any other that I have met with in the fossil state. It is arranged in the same complex mode that we observe in the sponges of commerce; but the fibre is exceedingly large, and appears to have been surrounded by a villous coat. It has either been furnished with a cavity whose size has been but very little less than its external diameter, or it has had a solid fibre like the greater number of the recent keratose sponges; but it is exceedingly difficult to decide under the present circumstances which form of structure it was that prevailed previous to its becoming fossilized. In cutting and polishing the specimen, half or a third of the substance of some of the fibres have been removed, so as to afford clear sections of them in a longitudinal direction; and wherever this has occurred, there are one or two minute vessels to be seen nearly in the centre of the fibre, running in the direction of its axis. These vessels are uniform in diameter and simple in their structure, and but very rarely dividing or sending off a branch. Within these vessels, at intervals, there are pellucid round globules, which entirely fill, or very nearly so, their internal diameters, as seen in Pl. III. fig. 7. The vessels represented in this case are from the

1000th to the 2000th of an inch in diameter, and the globules vary from the 1000th to the 2380th of an inch. In other parts of the interior of the fibre which are exposed by these sections, there are globular bodies occasionally to be seen of a much larger diameter, some of them measuring the 300th of an inch: these are frequently quite opake; but occasionally they are somewhat semipellucid at their margins, and possess all the characters which are usually observed in the young gemmules in a very early stage of their development, as they are seen in other similar fossil specimens. Upon examining other parts of the agate, there are large round opake bodies seen imbedded in considerable numbers amid the fibres of the sponge, which present all the characters both of structure and situation that are observed in the numerous cases of the occurrence of the gemmules in the fossil state which I have before described. From the whole of these circumstances it appears exceedingly probable that these minute vessels are true ovarian ducts: the situation in which they are found, the simplicity of their structure, and the nature of their contents strongly favour this supposition. That they are not vessels of circulation may be inferred by the existence of another vascular system which I have described as occurring in both the recent and the fossil species on the external surface of the fibre, and within which vessels in the recent state numerous very minute particles were observed, that have all the characters which the true molecules of circulation in animals so low in the organic scale might be expected to possess. In another agate, that we have had occasion to refer to before, and from which a few fibres are figured to prove the existence of the gemmules in the fossil state, there are some appearances of a curious nature that seem to illustrate the idea of the vessels I have just described being ovarian ducts. In this agate to which I allude, there are no appearances of well-defined anastomosing fibres, but in place of these we have numerous long and simple thread-like fibres (Pl. I. figs. 5 and 6.), which appear to have suffered very much by decomposition, as their substance consists not of a regular tube or of a solid fibre, but of a congeries of minute separate particles of matter, as if resulting from the undisturbed decomposition of a vessel *in situ*. Sometimes even the indication of the former vessel is not present, but its original situation is pointed out by the existence of lines of minute black bodies arranged in straight or curved lines, such as they would assume if they were inclosed within vessels which had taken such directions. In other cases, these strings of incipient gemmules are seen as represented in some parts of Pl. I. figs. 5 and 6, contained

within the boundaries of the tubes. In this state there are rarely more than single gemmules following each other in succession, but sometimes, although not often, the vessels appear to have been much enlarged in diameter, and the gemmules are then indiscriminately dispersed within its cavity. In other cases they are considerably larger in size than those we have just described, and exceed in their diameter the vessel or its remains which accompany them, as if they had outgrown and burst their natural boundaries, or that the partial decomposition of the walls of the vessel had reduced its size beneath that of the globular bodies contained within it. From the structure of this series of vessels and their contents, and their close resemblance in every respect to those which I have described as being contained within the large sponge-fibres in the former case, there can be but little doubt, that whatever may have been their nature and purpose in the living animal, they are at any rate the same tissue, but under somewhat different circumstances.

I have examined a considerable number of cut and polished specimens of Egyptian jaspers: they consist of numerous layers of various colours, which are generally concentric, but not always so; for it is frequently evident that the manner in which the material forming the layers was disposed has been suddenly changed, and the stratification has assumed a direction which is nearly at right angles to other lines of the deposit, as if the finely comminuted material had been washed by small quantities at a time, and from different directions, into the cavity which may have formed the mould which had given the external shape to the mass. Upon examining polished specimens of these pebbles with a microscopic power of 150 linear, as opake objects by direct light, they are seen to consist of finely comminuted granules cemented together by a semi-transparent siliceous matter, very much resembling in its appearance that state in which the silex exists in the flints of the chalk and the cherts of the greensand formations. These granules are usually of a light buff or brown colour, irregular in their form, but varying very little in size; and the colouring matter with which we find the various strata of the pebble tinted appears to exist in the cementing matter, and not in the granules; for there is always a considerable mixture of light granules even in the darkest coloured bands of the stone, and this form and mode of disposition in no case appears to have been influenced by the varieties of colour.

Amid this mass of agglutinated matter, in many cases there are to be found imbedded hundreds of beautiful little foraminated shells of about the same size, and closely resembling in

form those which are found imbedded in the chalk flints; and some of the species so closely resemble those found in the Grignon sand of the calcaire grossier, as to render it very difficult, if not impossible, to decide whether they are or are not absolutely the same species. These organic remains are frequently found in much greater quantities in some of the strata of the pebbles than in others, which would seem to indicate that they had been accidentally cast in and there imbedded; and it often occurs that in the very next stratum to the one in which they abound few or none are to be seen.

I have examined a considerable number of specimens of Mocha stones, but have in no case observed any indication of organic remains in them; the moss-like appearance in many of them being evidently of dendritical origin. Occasionally there are appearances, as if beautiful thin organic tissues, somewhat similar to the reticulated cuticles of plants, had been imbedded in the mass. Sometimes they assume a nearly regularly reticulated form, while at others they present a series of irregularly shaped rings and spots much like those in the skin of the leopard; but in almost all such cases these appearances are accompanied by an evident fracture in the mass; and upon a careful examination of many specimens of this description, I am convinced that these appearances of organic structure are but some of the many curious results that arise from the infiltration between two closely approximating surfaces of fluids containing solutions of metallic substances. A mass of Hertfordshire pudding-stone which I examined appeared to consist entirely of large and small rolled pieces and fragments of chalk flints cemented together by crystalline quartz. The larger of the imbedded masses, especially, presented all the characteristic spongeous structure, spicula, and *Foraminiferæ* which are to be observed in almost every true chalk flint.

In all the specimens of agates and jaspers which I have examined, there are very frequently considerable spaces in which no remains of spongeous texture is to be seen; and these are filled up with silex, which in some cases assumes the form of chalcedony, while in others it has the banded appearance of the Scotch pebbles or agates, being arranged in a series of layers, which are more or less conformable to the shape of the surface presented by the surrounding spongeous mass. When the silex has a predisposition to the latter mode of arrangement, it frequently happens that we find the decomposed and free particles of the animal matter have assumed a form in accordance with the law which affects the disposition of the silex; but when the arrangement assumed is that of chalce-

dony, the effect is different; the radiating crystals of the chalcedony are then frequently found to have their terminations surrounded by a mass of molecules of the decomposed spongeous matter which has been driven before them during the process of crystallization, in the same manner that the decomposed cellular structure of fossil wood is frequently observed to be driven before the radiating crystals either of silex or carbonate of lime, whichever may form the fossilizing medium; and it not unfrequently happens, that both modes of arrangement of the siliceous matter may be observed in the same specimen, the radiating or chalcedonic arrangement of crystals being often based upon the agatized portion of the specimen.

In conclusion, I may be allowed to observe, that there are circumstances attending the elucidation of the subjects treated of in this paper, which envelopes them in a greater degree of difficulty than that which attends the investigation of other organic remains, inasmuch as the structure of recent sponges has been very little studied by modern naturalists, and then, excepting in very few instances, only in such a state and manner, as to throw, comparatively speaking, but very little light on their structure, either in the recent or fossil condition. The aspect of a spongeous body, when viewed without the assistance of a high magnifying power, is so widely different from its appearance beneath the microscope, as to render it highly probable that it would never be identified in the fossil state, unless the eye of the observer had been previously well practised in the investigation of the structure of the recent sponges, as well as of the fossil ones; and even then it must be remembered that we are viewing but the skeleton of the sponge. In the recent keratose species, the horny fibres, when alive, are surrounded by a mucous coat, and imbedded in fleshy matter, very little of which can be expected to remain *in situ* in the fossils; and we can only hope to find but obscure indications of its remains in the form of a turbid semi-decomposed mass, in which the more durable parts of the animal are imbedded, preserving, in some instances, their pristine form and beauty; more frequently in such a disorganized and confused state, as to surround their identification with many doubts and difficulties, and to require much patient investigation, and an acquaintance with their recent types, both in a state of perfect preservation and of nearly entire decomposition.

That the remains of sponges thus found in such abundance should almost in every case prove to be those of the keratose tribe, is what we might naturally expect to be the case; as in

the genus *Halichondria*, where the spicula form the skeleton in place of the horny fibre, the rapid decay of the fleshy matter which cemented them together would naturally lead to so quick a decomposition as to render their preservation in a fossilized state extremely improbable, when compared with those of the keratose tribe.

The results arising out of the investigation of these siliceous bodies, will not, I trust, be deemed unimportant to the science of geology. We find the layers of cherty nodules in the greensands of the Isle of Wight and other localities comprising nearly a third or a fourth of the whole mass of them: the numerous layers of flints in the chalk form also a most important portion of the deposit, and in other strata we find similar siliceous deposits prevail to a great extent; so that in reality, the sponges, by their continued attraction and solidification of the silex in solution in the water of the ancient ocean, have performed even a more important part in the gradual elevation of the land than the corals have accomplished during the countless ages of the past period.

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## XV.—*On some new Insects from Western Africa.* By the Rev. F. W. Hope, F.R.S., F.L.S.

[Continued from vol. ix. p. 496.]

Sp. 14. *Calochroa Strachani*, Hope. Long. lin. 9; lat. lin. 2½. Nigra, elytris lateribus elytrorum flavo-vittatis interneque irregulariter lineatis, macula aurantia ad humeros posita, lineaque longitudinali suturali flava, ante apicem terminata. Corpus infra violaceum, lateribus abdominis utrinque albidis capillis obsitis, pedibus concoloribus.

The above insect I received from Mr. Strachan of Sierra Leone: it seems closely allied to one received from Cape Palmas, which is much broken; as it is a remarkably fine species, it is here introduced. The following species are also from Cape Palmas: *Cicindela regalis, concinna, interrupta*, and *vittata*, all of Fabricius.

Sp. 15. *Desera viridipennis*, Hope. Long. lin. 3¾; lat. lin. 1¼. Viridis, antennis articulis binis primis atro-piceis, reliquis fusco-flavis et pilosis. Caput cyaneum, punctatum, mandibulis obscure ferrugineis. Thorax elongatus et cyaneus. Elytra viridia. Corpus infra concolor, femoribus flavis apicibusque atris. Tibiæ fusco-piceæ tarsis concoloribus.

This elegant insect inhabits Cape Palmas, and there are also other species in my collection from Sierra Leone and Equinoctial Africa, namely, *ruficollis* of De Jean, and *tropica* and *ioptera* of Hope.

Sp. 16. *Galerita anthracina*, Hope. Long. lin. 8; lat. lin. 2¼. Nigra, antennarum quatuor articulis primis atris et pilosis reliquis fusco-